Investigation of Sediments from NY/NJ Harbor Using Fourier Transform Infrared Radiation (FTIR) Spectroscopy

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Sediments in the NY/NJ Harbor are contaminated with polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins, furans, and metals from different anthropogenic sources. These contaminants make it difficult to dispose of the sediments removed during the dredging operations necessary for operation of the port. One particular partial solution is to decontaminate the dredged material using sediment washing with high-pressure water jets, chelators, and surfactants. The objective of this work is to investigate the nature of the organic contaminants in the raw sediment and in sediment following the washing procedure. The U2B FTIR spectrometer (Nicolet Magna 860) coupled with IR microscope (Nicolet Nic Plan) microscope is well suited for investigations of the organic contents of sediments at a grain size level. Use of the synchrotron beam as a source of IR radiation allows one to significantly reduce the irradiated area, down to diffraction limits (about 5 um) while retaining good spectral signal to noise ratio. Samples are deposited on IR-reflective slides and brought under the IR microscope. Grains of sediment with sizes in excess of about 0.020 mm are too absorbing of the IR radiation to permit application of this approach. Obvious changes are observed in the organic content of the as-dredged samples in comparison to those, which were cleaned using the sediment washing technology that used water jets, chelators, and surfactants. It was also found that there was a substantial variation in the spectra obtained from different grains of the two types of sediments.

We conclude from the results of this preliminary investigation that a combination of the FTIR microscopy with results of bulk analytical measurements of the organic and inorganic contaminants including determination of the total organic carbon content will be a powerful tool for optimizing the several steps in the sediment cleaning technology and for understanding the interactions between the naturally occurring organic materials, the anthropogenic organic materials, and the surfaces of the silts and clays comprising the sediments proper.